from a special fund subscribed by the members of the expedition, and amounting to 10,000*l*.

WITH the beginning of the present year the Geographical Society of Paris have begun to issue a fortnightly *Compte Rendu* of their proceedings, published within ten days after their meetings. A quarterly volume will also be issued containing memoirs and other papers of some length. This is a great improvement on the old *Bulletin*, which was often months behind date. The Society now numbers upwards of 2150 members.

WE may remind our readers that Mr. Edmund O'Donovan, so well known as the *Daily News* correspondent in the Trans-Caspian region, and more particularly at Merv, will read a paper before the Geographical Society, on March 27, on the geography of Merv and the surrounding country. The meeting will, we believe, be held as usual in the theatre of London University, at Burlington House.

AT the last meeting of the Geographical Society of Paris, M. Achille Raffray, Vice-Consul at Massowah, read an interesting paper on his journey in Abyssinia, and in the country of the Raya Gallas. It was announced during the evening, that one of the Society's gold medals had been awarded to M. G. Revoil, for his journeys in Somali-land, and another to Dr. Lenz, for his recent journey to Timbuktoo, the Logerdt prize medal to Dr. Montano, for his explorations in the Malayan Archipelago, and the new Jomard prize to Prof. Gaffarel, for his services in the cause of historical geography.

DIRECT news from Lieut. Bove, the leader of the Italian Antarctic expedition which started from Buenos Ayres, has been received in Italy. The expedition was most hospitably received at Buenos Ayres. The Government of the Argentine Republic has sent out a commission with the Italian Expedition for the purpose of carefully revising the survey of the coast of their country; thus the expedition now consists of four ships, viz. *Santa Cruz*, *Uruguay*, *Cape Horn*, and a steam barque. The *Cape Horn* is the largest vessel, and will proceed to the Antarctic regions, while the *Uruguay* will remain at Cape Horn. The *Santa Cruz* will attend to the coast survey. The expedition started on November 8, and Lieut. Bove hoped to leave Cape Horn by the end of December in order to sail across to South Shetland and Grahamsland. He hoped to be back at Tierra del Fuego by the end of March, to stay there till May, and then to leave for Buenos Ayres.

ON THE ELECTROLYSIS OF SULPHATE OF COPPER[1]

THE immediate object of this research was to examine various conditions connected with the transmission of electric currents through solutions of salts of copper, and to ascertain the influence of those conditions on the electro-chemical equivalent of copper, also to observe for any signs of conduction of electric currents by such liquids without electrolysis. In many of the experiments some difficulty was experienced in ascertaining the exact loss of weight of the anode, in consequence of finely-divided copper falling from it. The powder which fell off, exposing as it did a large surface to the liquid, was somewhat oxidised, and also in acid solutions freely dissolved, and its true weight, and therefore the exact loss of the anode could not be found.

Amongst the results obtained were the following:—that a porous partition in a solution of sulphate of copper affected the deposit only by preventing the products set free at the two electrodes becoming mixed together; a large surface of cathode diminished the amount of deposited metal, by allowing more copper to be re-dissolved by ordinary chemical action; the effect of diluting the liquid with sulphuric acid was to slightly diminish the amount of deposited copper; diluting the solution either with water, glycerine, propionic acid, solution of sulphate of sodium, borax, boracic acid, or of ammonic alum, had very little effect (and that variable) upon the amount of deposit; much less copper is deposited per unit of current in a hot liquid than in a cold one; without the influence of an electric current, a copper plate dissolved fifty-six times faster in an ordinary depositing solution of sulphate of copper at 180° F. than at 50 F.; the amount of copper deposited by aid of a current in such a liquid at 50° F. was about 18 per cent. greater than at 180° F.; with an electric current of small density, and a sufficiently corrosive liquid containing a very small amount of dissolved copper, no deposition of copper takes place; instead of an electric current protecting a copper cathode from chemical corrosion, it indirectly increases that corrosion; a sufficient rise of temperature (viz. from 50 F. to 180° F.) was nearly twice as influential as the electric current in increasing purely chemical corrosion; the purely chemical corrosion of a copper anode in ordinary sulphate of copper-depositing solution, is less than that of a separate piece of copper without a current; the loss of the anode is greater than the gain of the cathode in nearly every instance, and this difference is slightly greater with near electrodes than with distant ones; reduction of temperature is a most influential circumstance in diminishing the chemical corrosion of the two electrodes, and making their alterations of weight, by electrolytic action, approximate to each other; purely chemical corrosion of the copper is not entirely prevented by using a pure and cold solution not containing any free acid; the inequalities of loss and gain of the two electrodes are largely, if not wholly, due to purely chemical action; there exist relative degrees of chemical corrosive power and strength of current, at which the influence of the two are equal, and a copper cathode neither dissolves nor receives a deposit in an acidulated solution of sulphate of copper containing a very small amount of dissolved copper salt; the amount of copper deposited is not sensibly affected by the presence of a small amount of green sulphate of iron in the solution; nor by the exposure of such a solution freely to the air or to the light; differences of relative position of the electrodes to each other affect slightly both the amount of total loss of the anode per unit of current, and also the relative amount of such loss to the amount of gain of the cathode; the presence of a considerable quantity of persulphate of iron in the solution affects perceptibly the amount of deposited copper, but that of a moderate proportion of nitrate of copper in the solution had no conspicuous effect of the kind; the chemical corrosion of sheets of copper in pure acidulated solution of sulphate of copper was not directly proportionate to their amount of surface, but was relatively less upon the larger surface; the amount of copper deposited per unit of current did not vary much with the magnitude of the cathode or the density of the current; a very feeble thermo-electric current caused a cold copper anode to lose a little more, and a hot cathode to lose slightly less, than without the current; stirring the solution increased slightly the loss of weight of the anode per unit of current, and diminished to a small extent the gain of the cathode; stirring a pure acidulated solution of sulphate of copper increased the proportion of loss of weight of copper by ordinary chemical corrosion without an electric current from ·07 grain to ·17 grain, or from ·411 to 1·0, but in a less proportion if a current was entering the copper as a cathode; a considerable degree of density of current appears to be favourable to enabling a nearer approximation to be made to the true electro-chemical equivalent in the weight obtained of deposited copper.

Many of the experiments indicate, and the whole of them are consistent with the general inference, that in nearly all cases of electrolysis, the two forces, ordinary chemical and electro-chemical, coexist and operate independently at the same surfaces of liquid and metal; that ordinary chemical action, both of simple oxidation and of corrosion of both electrodes by free acid, takes place in all cases, and is a phenomenon essentially distinct from, and independent of, electro-chemical corrosion of the anode, and deposition upon the cathode. The two classes of phenomena, however, are coincident, and affect each other in various indirect and secondary ways.

In consequence of these two actions being essentially distinct and independent of each other, an electric current passing out of a piece of copper into an acid solution does not directly increase the rapidity of ordinary chemical corrosion of the metal, nor does a current entering from such a liquid into a copper cathode, protect in all cases that metal from such corrosion.

Some of the experiments show that stirring the liquid increases the ordinary chemical corrosion both of the anode and of the cathode, and therefore that the technical process of swaying to and fro by mechanical means, articles which are being plated in a depositing solution, tends to corrode them.

That temperature also greatly influences the chemical corrosion is proved by the numerical results. The higher the temperature the greater was the amount of chemical solution of the hot copper without current, and of the hot electrodes; and for equal rise of temperature, the increase of corrosion appeared to be

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[1] Abstract of a paper read before the Birmingham Philosophical Society, January 26, 1882. By G. Gore, LL.D., F.R.S.

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greater at high temperatures than at low ones, because the corrosion itself produced heat.

A considerable deficiency of deposited copper, sometimes amounting to 18 per cent., may result by ordinary chemical corrosion through employing a hot solution. This fact is worthy of consideration in the electro deposition of copper for commercial purposes.

The greatest obstacle to finding the electro-chemical equivalent of copper was the difficulty of determining how much the ordinary chemical corrosion was decreased at the anode or increased at the cathode by the electric current, and the next greatest obstacle was the disintegration of the anode, and the dissolving of the powder by chemical action. Notwithstanding that the cathode is more corroded by purely chemical action than the anode, the gain of weight of the former is the least inaccurate, because of the unavoidable disintegration of the anode. Substantially the method does not admit of a great degree of accuracy, because the chemical corrosion of copper, even in a cold neutral solution of cupric sulphate, causes a loss of that metal, and prevents the true weight being obtained. The correction cannot be accurately, but may be approximately, found, by using a comparison sheet of copper in the same liquid without a current. The corrosion of such a sheet is, however, somewhat less than that of the cathode. The nearest approach to the true number appears to be obtained by using a cold neutral solution, small narrow horizontal electrodes, and rapid deposition without stirring, continued during only a short period of time.

No signs were observed in any of the experiments of ordinary electric conduction unattended by electrolysis.

The results of this research also afford information respecting the degree of accuracy of the method of measuring by means of electrolysis of a solution of cupric sulphate, the amount of electric current consumed in electric lighting, and states the conditions under which the degree of inaccuracy of such a method of measurement is the least. It is a remarkable circumstance that an electric current entering a copper cathode from a strong mixture of sulphuric acid and water, instead of protecting the copper, actually increases its chemical corrosion; by what means it does this is now being investigated by the author.

UNIVERSITY AND EDUCATIONAL INTELLIGENCE

OXFORD.—The examiners for the Burdett-Coutts Geological Scholarship have recommended for election Mr. G. A. Buckmaster, B.A., of Magdalen College. Mr. R. Chalmers, B.A., of Oriel, also distinguished himself in the examination. The scholarship is tenable for two years.

CAMBRIDGE.—Notice has been given that one of the Cambridge local examinations will be held in September next, commencing on Monday, 4. This is, partly, for the convenience of students who desire to pass a preliminary examination required by the General Medical Council previous to registration as medical students. Many students used to resort to the College of Surgeons for this purpose, but the College has ceased to hold such an examination, and it is at the instance of the Medical Council that a local examination is to be held in September for the accommodation of the medical students. The examination is also intended to enable students who intend entering the University in October to obtain, before going up to Cambridge, the certificates which will excuse them from the previous examination of the University. They will find it a considerable advantage to do this, for, in addition to the time so gained, having gone through the required test of school education through the local examination in September, they will be able at the beginning of the October term to join the classes of the several professors (of natural science, medicine, and others) at the commencement of the several courses. Hitherto many passed the previous examination in December, and many at a later period. Now the arrangements are such that all have the opportunity, through the Oxford and Cambridge Schools Board Examination in June, or through the local examination in September, of obtaining certificates which will wholly, or partly, exempt them from the previous examination; and it is obvious that those who take the advantage of this opportunity will have the start of their fellows in the University race. The September examination will be held on September 4, in Cambridge and London, and other places in which there may be sufficient candidates. The requisite forms to be filled up and sent in before August 1, may be obtained, with other information, for Cambridge, from Rev. G. F. Browne, St. Katharine's College; and for London, from Mr. R. Sc. I. Corbet, 10, Portman Street, London, W.

PROF. HUMPHRY announces that Mr. Donald McAlister will give a course of lectures on the Mechanics of the Human Skeleton in the Easter Term, beginning on Wednesday, April 26.

THE Cambridge University Natural Science Club celebrated the tenth anniversary of their foundation by holding a dinner in the hall of Downing College (kindly granted for the occasion) on March 11. Dr. Michael Foster, Sec.R.S., occupied the chair, and there was a large gathering of old and present members and their friends. It is worthy of note that seven Professorial chairs in science and ten Fellowships, besides other dignities, are at present occupied by former members of the Club in the short time that has existed since its foundation.

VICTORIA UNIVERSITY.—The Council have appointed the following as external examiners of the University:—In Classics, the Rev. R. Burn, M.A., Fellow of Trinity College, Cambridge; In English Language and Literature, Mr. T. C. Snow, M.A., Fellow of St. John's College, Oxford; in French, M. E. Joël, Mason College, Birmingham; in German, Prof. C. A. Buchheim; in Philosophy, Mr. James Sully, M.A.; in Political Economy, Mr. W. H. Brewer, M.A.; in Mathematics, Mr. John Hopkinson, M.A., D.Sc., F.R.S.; in Engineering, Mr. John Hopkinson, M.A., D.Sc., F.R.S.; in Physics, Prof. A. W. Rucker, M.A.; in Chemistry, Prof. H. E. Armstrong, F.R.S.; in Physiology, Mr. J. Langley, M.A., Fellow of Trinity College, Cambridge; in Zoology, Mr. Patrick Geddes, Demonstrator in Botany in the University of Edinburgh; in Botany, Mr. S. H. Vines, M.A., D.Sc., Fellow of Christ's College, Cambridge; in Geology and Palæontology, Prof. T. Rupert Jones, F.R.S.

SOCIETIES AND ACADEMIES

LONDON

Zoological Society, February 12.—Prof. W. Flower, LL.D., F.R.S., president, in the chair.—Mr. F. Moore read a paper containing an account of the Lepidoptera collected by the Rev. J. H. Hocking, chiefly in the Kangra district, North-west Himalaya, with descriptions of new genera and species.—A communication was read from Mr. G. A. Boulenger, C.M.Z.S., in which he gave the description of a Frog (*Phyllomedusa hypochondrialis*) lately living in the Society's Gardens. This Frog had been obtained at Pernambuco, and was believed to be the first example of the species that had reached Europe alive. Attention was drawn to the peculiar coloration, as being worthy of notice, it not having been described before.—Mr. Oldfield Thomas read a paper containing the descriptions of a small collection of Rodents which had been obtained by the late Mr. B. J. Andersson in Damara Land and in the neighbouring countries. The collection contained examples of a new species of Mouse, which was proposed to be named *Mus nigricauda*.—Mr. W. A. Forbes gave a description of the pterylosis of *Mesites*, and made some remarks on the position of that genus, which he considered to be most nearly allied to *Rhinochetus* and *Eurypyga*, though all these three forms should be referred to different families.—Prof. St. George Mivart read a series of notes on the anatomy of the Canada Porcupine (*Erithizon dorsatus*).

Chemical Society, March 2.—Prof. Roscoe, president, in the chair.—The following papers were read:—On the action of aldehydes on phenanthraquinone in presence of ammonia (third notice), by F. R. Japp and F. W. Streatfeild. With aldehydes of the benzene series and furfuraldehyde, compounds belonging to the class of substances obtained by Ladenburg (*Ber.* ix. 1524) were obtained; with hydroxyaldehydes of the benzene series, compounds of the character of the anhydrobases described by Hübner were formed; with the methyl ether of salicylaldehyde a mixture of both the above bodies is obtained. The authors conclude that the above reactions are most readily accounted for on the assumption that phenanthraquinone has the peroxide constitution ascribed to it by Graebe.—Application of the aldehyde and ammonia reaction in determining the constitution of quinones, by F. R. Japp and F. W. Streatfeild. The authors state that the occurrence of this reaction and the formation of compounds resembling those above described, may be taken as a proof of the ortho position in quinones.—On the solubility of glass in certain reagents, by R. Cowper. The author has determined the quantity of matter dissolved out of glass by ammonium

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